BROADCOM®

Reliability Data Sheet

HCPL-817/HCPL-814

Phototransistor Optocouplers High-Density Mounting Type

Description

The reliability data shown includes Broadcom Inc. reliability test data from the reliability qualification done on this product family. All of these products use a similar IC and the same packaging materials, processes, stress conditions, and testing. The data in Table 1 and Table 2 reflects actual test data for devices on a per-channel basis. Before stress, all devices are preconditioned at MSL 1 using a solder reflow process (260°C peak temperature). This data is taken from testing on Broadcom devices using internal Broadcom processes, material specifications, design standards, and statistical process controls. *The data is not transferable to similar part types from other manufacturers*.

Operating Life Test

For valid system reliability calculations, it is necessary to adjust for the time when the system is not in operation. Note that if you are using MIL-HDBK-217 for predicting component reliability, the results may not be comparable to those given in Table 2 due to different conditions and factors that have been accounted for in MIL-HDBK-217. For example, it is unlikely that your application will exercise all available channels at full rated power with the IC always ON as Broadcom testing does. Thus, your application total power and duty cycle must be carefully considered when comparing Table 2 to predictions using MIL-HDBK-217.

Definition of Failure

Inability to switch, that is “functional failure,” is the definition of failure in this data sheet. Specifically, a failure occurs when the device fails to switch ON with 2 times the minimum recommended drive current (but not exceeding the maximum rating) or when the device fails to switch off when there is no input current.

Failure Rate Projections

The demonstrated point mean time to failure (MTTF) is measured at the absolute maximum stress condition. The failure rate projections in Table 2 use the Arrhenius acceleration relationship, where a 0.43-eV activation energy is used as in the hybrid section of MIL-HDBK-217.

Application Information

The data in Table 1 and Table 2 was obtained on devices with a high-temperature operating life duration. An exponential (random) failure distribution is assumed, expressed in units of FIT (failures per billion device hours), which are defined only in the random failure portion of the reliability curve.

Table 1: Demonstrated Operating Life Test Performance

Stress Test Condition	Total Devices Tested	Total Device Hours	Number of Failed Units	Demonstrated MTTF (hr) @ Ta = +110°C	Demonstrated FITs @ Ta = +110°C
Ta = 110°C If = 20 mA Ic = 30 mA	557	557,000	0	> 557,000	< 1,795

Table 2: Reliability Projection for the HCPL-817/HCPL-814 Devices

Ambient Temperature (°C)	Junction Temperature (°C)	Typical (60% Confidence)		90% Confidence	
		MTTF (Hr/fail)	FITs (Fail/10^9h)	MTTF (Hr/fail)	FITs (Fail/10^9h)
110	125	607,886	1645	241,902	4134
100	115	839,365	1191	334,017	2994
90	105	1,178,945	848	469,149	2132
80	95	1,686,767	593	671,232	1490
70	85	2,462,109	406	979,772	1021
60	75	3,672,817	272	1,461,561	684
50	65	5,610,078	178	2,232,474	448
40	55	8,793,385	114	3,499,240	286
30	45	14,178,141	71	5,642,049	177
25	40	18,210,506	55	7,246,689	138

Table 3: Mechanical Tests (Testing Done on a Constructional Basis)

Test Name	MIL-STD-883	Test Conditions	Units Tested	Units Failed
Temp Cycling	1010 Cond. B	–55 to 125°C Transfer < 5 minutes Dwell = 15 minutes 1000 cycles	519	0
Solderability (Pb-free condition)	2003	8 hours steam aging, Solder DIP (1x, 260°C)	142	0
Solderability (SnPb condition)	2003	8 hours steam aging, Solder DIP (1x, 245°C)	142	0
High-Temperature Storage Test	1008	Ta = 150°C Unbiased Time = 1000 hours	219	0
Low-Temperature Storage Test	—	Ta = –55°C Unbiased Time = 1000 hours	219	0
Preconditioning	J-STD-20	As per reference standard (to conform to MSL 1)	1753	0

Table 4: Environmental Testing

Test Name	MIL-STD-883	Test Conditions	Units Tested	Units Failed
Temperature Humidity Bias	N/A	Ta = 85°C, RH=85% Vce = 64V Time = 1000 hours	264	0
Unbiased Autoclave	N/A	Ta = 121°C, RH = 100% Unbiased Time = 96 hours	279	0
High-Temperature Reverse Bias	N/A	Ta = 110°C Vce = 80V Time = 1000 hours	77	0